THE GEOGRAPHICAL INFORMATION SYSTEM PROJECT FOR THE MANAGEMENT OF THE COLUMBRETES ISLANDS NATURAL RESERVE (E SPAIN).

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A brief approach to the Columbretes Islands

The Columbretes Islands, a volcanic archipelago 55 km E off the Castellón coast (E-Spain) with an approximate surface of 19 Ha, is made up of 10 small islands distributed in four groups. The largest islands are known as Illa Grossa (13.33 Ha, 67 m), Illa Ferrera (1.53 Ha, 43 m), Illa Foradada (1.63 Ha, 55 m) and Illa Carallot. Of these, only the first three islands are large enough to harbour vascular plant species. The archipelago is noteworthy for the uniqueness of some species of its flora and for some of its vegetation types. Additionally, it is an important site for seabirds.

The Columbretes islands –emerged portion- were declared Natural Park by the Autonomous Government of the Valencian Community in 1988. Subsequently, in 1991, the marine environment of the Columbretes archipelago was declared Marine Reserve in order to preserve its outstanding richness. The Natural Reserve comprises an area of 4400 Ha surrounding the islands.

Natural richness and main species

The most important vascular plants species are *Lobularia maritima* (L.) Desv. subsp. *columbretensis* R. Fern., an endemic restricted to the archipelago, and *Medicago citrina* (Font Quer) Greuter, endemic to the archipelago and the Ibiza island. Additionally, interesting plants such as the rare *Fumaria munbyi* Boiss. & Reuter and *Lavatera mauritanica* Durieu subsp. *davaei* (Coutinho) Coutinho can also be found (LAGUNA & JIMÉNEZ, 1995).

The vegetation of the archipelago was studied by BOLÒS (1989, 1992), BOLÒS & VIGO (1984) and CARRETERO & BOIRA (1987). These studies described some new associations among which *Medicagini citrinae-Lavateretum arboreae* O. Bolòs, R. Folch & J. Vigo 1984 (a tall shrub dominated by wild mauves in addition to the arborescent endemic alfalfa) and *Euphorbio terracinae-Lobularietum maritimae* (*columbretensis*) J.L. Carretero & H. Boira 1987 (prairies with tall grasses interspersed with *Lobularia maritima* subsp. *columbretensis*) are noteworthy for their singularity.

The archipelago is home to one of the largest nesting colony of the rare mediterranean gull *Larus audouinii* (JIMÉNEZ & CARDA, 1997; ORO & PRADEL, 1999) in addition to other sea birds such as Cory's Shearwater (*Calonectris diomedea*), European Shag (*Phalacrocorax aristotelis*), European Storm-petrel (*Hydrobates pelagicus*) and Eleonora's Falcon (*Falco eleonorae*) (PECHUAN, 1987). The Columbretes are also used by numerous migrant bird species as a resting place, so that abundant records on rare

species such as *Trichodorma muraria*, *Charadrius morinellus* and *Calcarius lapponicus* are available (PECHUAN, *l. c.*). (Table 1).

Recreational Use

The Columbretes islands are an important recreational resource. Activities such as submarine fishing and scuba diving are strictly regulated. Guided visits to the largest island are also allowed but only a maximum of 60-80 persons per day during the summer months, and up to 24 the rest of the year, can enter the island. In addition, the Illa Grossa bay is used by numerous recreational yachts as a fastening place.

Natural Reserve Management

1.- Recovery Plan for the Vegetation
The native vegetation of the Illa Grossa was exposed to continuous perturbations since the late 1850s (SALVATOR, 1895). The perturbating factors inflicting the greatest damage were the deliberate propagation of fires together with the clearing of the shrublands and the introduction of domestic animals (especially rabbits). This resulted in the complete disappearance of the climax vegetation -*Chamaeropo humilis-Rhamnetum lycioidis* O. Bolòs 1957- and the extinction of woody plants in the Illa Grossa. Scattered fragments of this vegetation remain only in the Illa Ferrera. In order to recover the native vegetation a recovery plan has been elaborated (LAGUNA & JIMÉNEZ, 1995). Priorities include: i) rabbit eradication, ii) construction of barriers to prevent soil erosion, iii) reinforcement of natural vegetation taking into account the ecological and natural dynamism.

2.- Management of Activities
Coast wardens are responsible for controlling all the activities carried out in the islands, such as scuba diving, fishing or guided visits along the promenade in the main island, as well as controlling colonies, nesting, bird ringing and seabird census (Tables 2, 3, 4 and 5).

Presentation of the main objectives of the project

The objectives of the project are twofold:
1.- Establishing of a departure point for subsequent monitoring of vegetation succession patterns and ecological processes, especially avian communities-vascular plant relationships in the emerged portion of the Illa Grossa. This initiative could be extended to the totality of the natural reserve:

1a - Mapping of the vegetation
1b - Mapping of the most interesting plant species
1c - Mapping of the nesting sites of the most important bird species

2.- Design a GIS-based tool which allows efficient management of the natural reserve and of the research activities carried out in the islands (LANG, 1998).

Methods

The division of the Illa Grossa into defined square plots, which results from the subdivision of the 100 x 100 m UTM grid plots -European Datum-, will allow the development of a raster type GIS. Available information on flora, fauna, soil characteristics in addition to new available information will be recorded on database associated to each plot.
In order to map the existing vegetation, floristic and phytosociological inventories (*v*. RIVAS-MARTÍNEZ, 1997) will be carried out in each plot. Up to a maximum of three of the phytosociological associations described in the islands will be assigned to each plot. At the same time, every plant species found in each plot will be recorded in the database for floristic mapping purposes.

Finally, data concerning recreational activities will also be incorporated in the GIS.

Expected results

The establishment of the GIS associated to each plot will permit a quick recording of the information available on everyday activities both in the recreational and management/research/conservation fields. The latter include:

- Reinforcement of plant populations according to the existing recovery plan of the vegetation of the islands
- Seed collection of the most interesting species
- Establishment and maintenance of barriers to decrease erosive processes.
- Census and monitoring of nesting seabirds
- Monitoring of the recreational use of the bay by yachts

Simultaneously, once the baseline level of the vegetation mapping has been established, yearly monitoring of the vegetation on each of the plots will permit to gain knowledge into the existing relationships between seabird populations and natural vegetation dynamics.

Discussion

Although the selected Raster-type-based approach is a powerful and fast alternative to meet the requirements exposed above, it is hindered in some way by the choice of the plot size. Therefore, a compromise between the required detail and the managing and technical capabilities must be reached in order to ensure efficient monitoring of the plots.
An additional problem is posed by the fact that *in situ* identification of each of the plots is painstaking. However, since the defined plots result from the subdivision of the 100 x 100 m UTM grid plots, the use of a highly reliable GPS receiver will most likely facilitate this task.

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References

BOLÒS, O. (1989). La vegetaciò d'algunes petites illes properes al litoral de la Península Ibérica. *Folia Bot. Miscel. (Barcelona)* 6:115-133.

BOLÒS, O., ed. (1992). Plantes vasculars del quadrat UTM 31SCE01: Els Columbrets. *ORCA, Catálegs florístics locals* 4: 1-37.

BOLÒS, O. & J. VIGO (1984). Flora vascular i vegetació de les Illes Medes. *In* ROS, J. *et al*., Els sistemes naturals de les Illes Medes. *Inst. Estud. Catalans, Arx. Secc. Cien*., nº 73.

CARRETERO, J.L. & H. BOIRA (1987). La vegetación de las Islas Columbretes. *In* ALONSO, L.A. *et al*., coords. *Islas Columbretes. Contribución al estudio de su medio natural*. Generalitat Valenciana, Conselleria de Administración Pública, Agencia del Medio Ambiente. Valencia.

JIMÉNEZ, J. & CARDA, J (1997) Invernada de la Gaviota de Audouin *Larus audouinii* en las Islas Columbretes. *Ardeola* 44(2):183-189.

LAGUNA, E. & J. JIMENEZ (1995). Conservación de la flora de las islas Columbretes (España). *Ecologia Mediterranea* 21(1/2): 325-336.

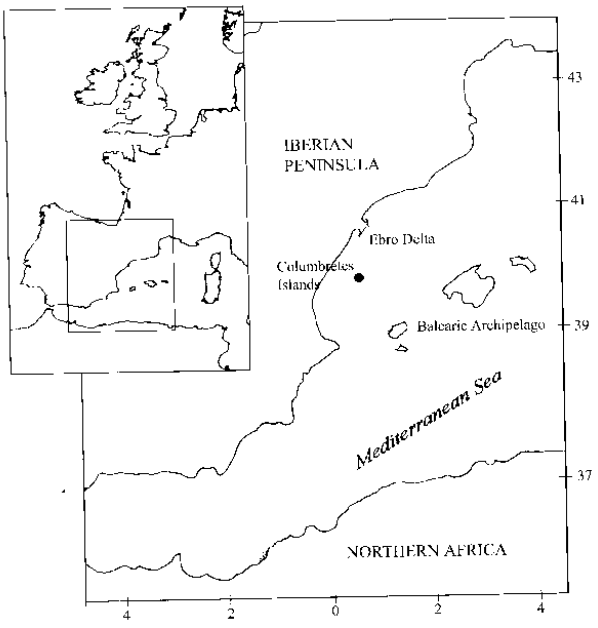
LANG, L. (1998). *Managing Natural Resources with GIS*. ESRI Press.

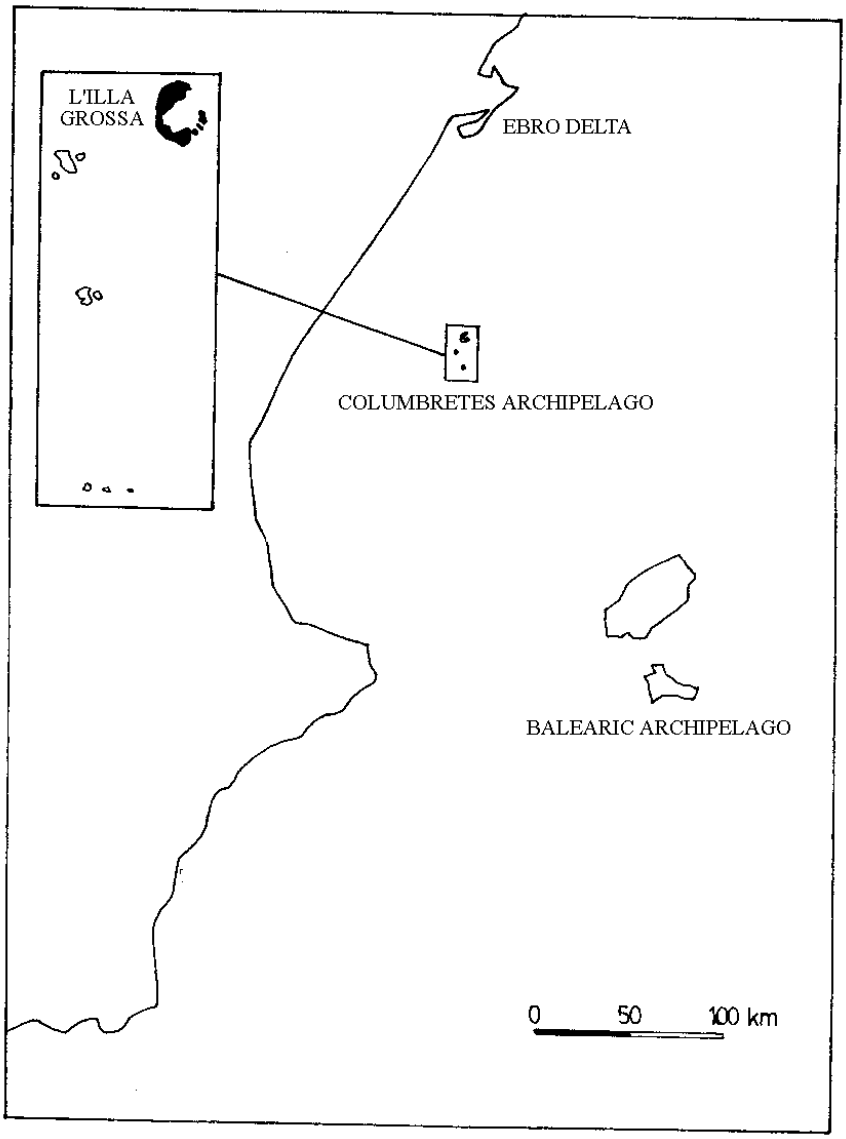
ORO, D. & PRADEL, R. (1999) Recruitment of Audouin's gull to the Ebro Delta colony at metapopulation level in the western Mediterranean. *Marine Ecology Progress Series*, 180:267-273.

PECHUAN, L. (1987). Introducción al estudio ornitológico de las Islas Columbretes. *In* ALONSO, L.A. *et al*., coords. *Islas Columbretes. Contribución al estudio de su medio natural*. Generalitat Valenciana, Conselleria de Administración Pública, Agencia del Medio Ambiente. Valencia.

RIVAS-MARTÍNEZ, S. (1997). Syntaxonomical synopsis of the potential natural plant communities of North America, I. *Itinera Geobotanica* 10: 5-148.

SALVATOR, L. (1895). *Columbretes*. Ed. Mercy. Praha.


IBERIAN
PENINSULA
Ebro Delta
Columbretes
Islands
Balearic Archipelago
Mediterranean Sea
NORTHERN AFRICA
43
41
39
37
4
2
0
2
4


L'ILLA
GROSSA
EBRO DELTA
COLUMBRETES ARCHIPELAGO
BALEARIC ARCHIPELAGO
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100 km